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PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) FUEL CONTROL VALVE FOR A GAS TURBINE ENGINE

(71) We, MOTOREN- UND TURBINEN-UNION MÜNCHEN GMBH, a German Company, of 8 München 50, Postfach 50 06 40, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a fuel control valve for a gas turbine engine.

In the operation of modern gas turbine engines the problem arises of draining the unused fuel from the fuel nozzles after the engine has been shut down. When the engine is shut down, fuel collects in the combustion chambers because it drains from the pipes leading from the fuel tank, so that when the engine is started again the fuel can be readily combusted and consequently an excess in temperature can result in the combustion chamber. This excess in temperature can lead to damage in the engine, and it is therefore preferable to drain this fuel from the engine when shutting down.

According to the present invention, in or for a gas turbine engine, a fuel control valve comprises an open-ended cylinder, a piston spring-biased towards one end in the cylinder, first and second nipples closing opposite ends of the cylinder and providing respectively, first and second fluid transfer ports, the valve having also a third fluid transfer port, there being in the valve a first fluid flow path between the third port and the first port and a second fluid flow path between the third port and the second port, said piston being movable from said one end position in which it closes the first fluid flow path and leaves the second fluid flow path open to an opposite end position in which it opens the first fluid flow path and closes the second fluid flow path, there being at the inner ends of the nipples respective sealing means which serve as fluid seals against the piston when in its end positions.

In order that the invention can be more clearly understood, reference will now be made to the accompanying drawings, in which:

Figure 1 is a mean section in a longitudinal direction of a fuel control valve according to an embodiment of the invention and connected in the fuel supply path of a gas turbine engine, schematically represented, and

Figures 2 and 3 show the valve of Figure 1 with its piston in respectively an intermediate and one end position whereas in Figure 1 it is shown in the other end position.

Referring to Figure 1, a gas turbine engine 1 comprises a compressor 2, combustion chambers 3 and 4, a turbine 5 and fuel nozzles 6 and 7 of the combustion chambers 3 and 4. The fuel system of the engine comprises a fuel tank 8, to which is attached a supply pump 9 from which a supply line 9a runs to a fuel pump 10, which supplies the fuel to a fuel control unit 12 via a further pipe 11. The fuel control unit 12 is connected to a pump return line 13, which is connected to the supply line 9a upstream of the pump 10. The fuel control unit 12 supplies the fuel quantity necessary for the operation of the gas turbine engine 1, via a pipe 14 to the control valve 15.

Valve 15 comprises a cylinder 16, a spool 17 and a compression spring 18. Into each end of the cylinder there is screwed a threaded double-ended nipple 19 and 20, and circular shoulders thereon position annular seals 21 and 22 on the inner ends of the double-ended nipples 19, 20. On the outside of the cylinder 16 is a swivelling connection 23 consisting of a cylindrical connection part around the cylinder 16 and a radial part integral with this cylindrical part. In this

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connection 23 two annular seals 24, 25 are positioned, which seals are axially spaced relative to the longitudinal axis of the valve. The connection 23 is restrained from movement axially of the cylinder 16 by means of a retainer-ring 26 and a retainer-ring 27.

During operation of the engine fuel flows via pipe 14 into the double-ended nipple 19 and is applied to the end face 28 of the spool. The spool is pushed under pressure against the spring 18 and closes a control port 29 (Figure 2), while a second control port 30 is still closed; through an increase in pressure, the spool 17 comes into contact with the seal 22 (Figure 3) and clears the control port 30 so that fuel can flow via swivelling connection 23 and pipe 31 (Figure 1) to the fuel nozzles 6 and 7. When the engine, and the fuel supply too, are shut down, the spool 17 comes into contact with the seal 21 (Figure 1) and clears the control port 29 so that fuel which is still in the fuel nozzles 6 and 7 and in the pipe 31, flows, by means of for example the gas pressure still present in the combustion chambers 3 and 4, via the swivelling connection 23, the control port 29 and the double-ended nipple 20, off into a drainage pipe 32.

The spool 17 is lapped in the cylinder 16 thus guaranteeing a smooth movement and a reliable motion across the control ports 29 and 30. The double-ended nipples 19 and 20 are so designed that their seals 21, 22 serve as a stop and a seal for the spool 17 and are also sealed against the cylinder at the same time; this prevents leakage of fuel between the nipples 19, 20 and the cylinder 16 in the intermediate position and between the spool 17 and the respective nipple when the fuel flows under all the other operating conditions. The seals 21, 22, 24, 25 provided for the pressure maintaining and drainage valve can be O-rings of a generally conventional design made from a wear-resisting material.

The gas turbine engine depicted in Figure 1 does not represent a mandatory type for the use of the control valve according to the invention. The valve can just as well be used in multi-shaft gas turbine engines as in gas turbine engines for stationary operation, equipped with can-type or annular combustion chambers and with one or more fuel nozzles.

WHAT WE CLAIM IS:—

1. In or for a gas turbine engine a fuel control valve comprising an open-ended cylinder, a piston spring-biased towards one end in the cylinder, first and second nipples closing opposite ends of the cylinder and providing respectively first and second fluid transfer ports, the valve having also a third fluid transfer port, there being in the valve a first fluid flow path between the third port and the first port and a second fluid flow path between the third port and the second port, said piston being movable from said one end position in which it closes the first fluid flow path and leaves the second fluid flow path open to an opposite end position in which it opens the first fluid flow path and closes the second fluid flow path, there being at the inner ends of the nipples respective sealing means which serve as fluid seals against the piston when in its end positions.

2. A fuel control valve according to claim 1, wherein each sealing means is ring-shaped and is located between the inner surface of the cylinder and a circular shoulder on the inner end of the pertaining nipple.

3. A fuel control valve according to claim 1 or claim 2, comprising a cylindrical connection part surrounding a mid-portion of the cylinder and sealed thereto by annular seals, which are axially spaced relative to the longitudinal axis of the valve, in such manner that the connection part can be swivelled round said cylinder, said connection part having said third port therein which can communicate with the inside of the cylinder via a control port in the cylinder.

4. A fuel control valve according to claim 3, wherein the connection part is restrained from axial displacement relative to the cylinder by circumferential retainer rings located in the surface of the cylinder.

5. A fuel control valve according to claim 3 or claim 4, wherein there are two such control ports axially spaced apart by a distance slightly less than the effective length of the piston.

6. In or for a gas turbine engine a fuel control valve substantially as hereinbefore described with reference to the accompanying drawings.

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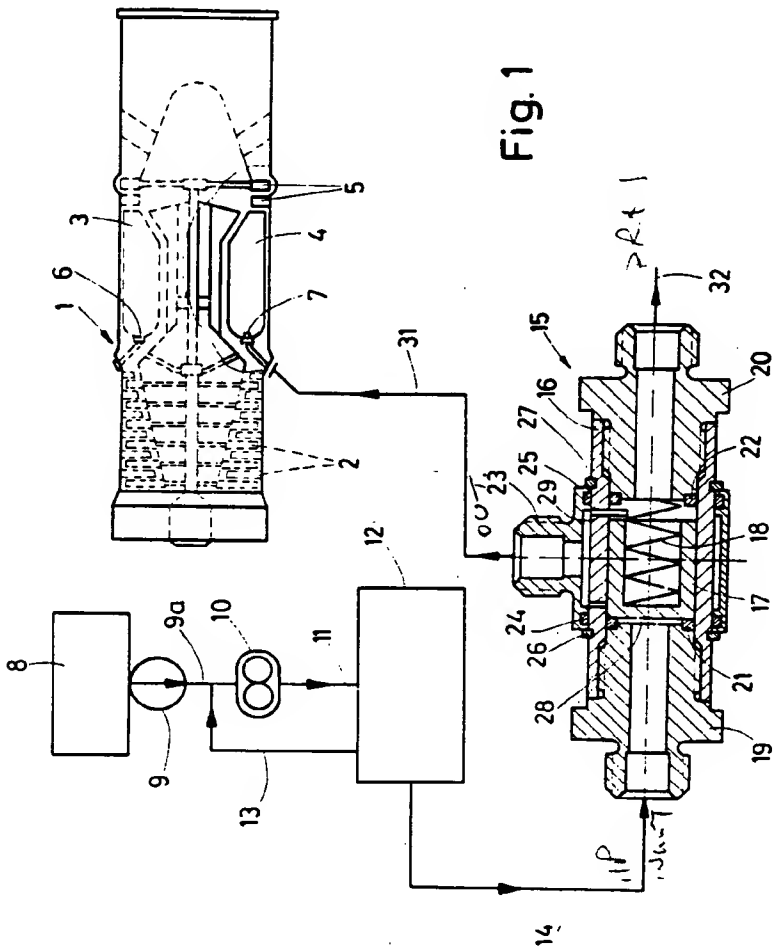
Fig. 1



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Sheet 2

Fig. 2

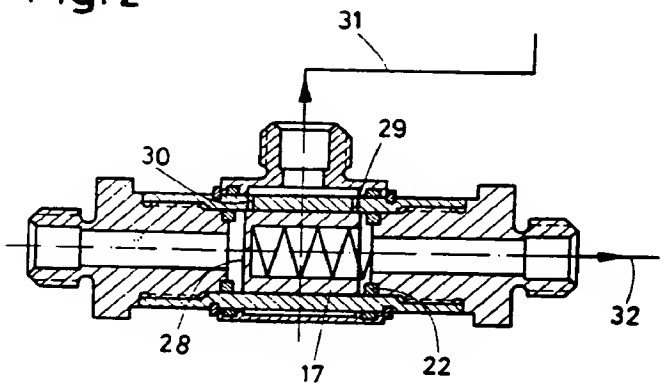

Fig. 3